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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors: Katsuhito Kitahara, et al. Group No. 2624

Serial No.: 10/033,674 Examiner: G. Garcia

Filed: December 27, 2001

Title: Logo Data Generating System, Logo Data Generating Method, And Data Storage Medium

CERTIFICATE OF MAILING

I hereby certify that this transmittal and the documents attached hereto are, on this date, being deposited with the United States Postal Service with sufficient postage as First Class mail in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Date: October 7, 2002

Virginia Silva

Submission of English Translation of Non-English Language Provisional Application in Support of Claiming Benefit of Earlier Filing Date Under 37 C.F.R. §1.78(a)(5)

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Enclosed is an English translation and accompanying statement of accuracy of translation of the non-English language provisional application filed on September 7, 2001 to which this application claims priority.

Respectfully submitted,

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Docket No.: P6395a **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Katsuhito Kitahara, et al.

Serial No.:	10/033,674	Group No.:	Not Yet Assigned
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Title: LOGO DATA GENERATING SYSTEM, LOGO DATA GENERATING METHOD, AND DATA STORAGE MEDIUM

Assistant Commissioner for Patents
Washington, D.C. 20231

STATEMENT OF ACCURACY OF TRANSLATION
(37 C.F.R.§§ 1.52(d), 1.55(a), 1.69)

I, the below named translator, hereby state:

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That I am knowledgeable in the English language and in the language of the

[ ] attached document

[x] below identified document

and I believe the attached English translation to be a true and complete translation of this document.

The document for which the attached English translation is being submitted is

U. S. Provisional Patent Application No. 60/317,794 (Atty Docket No.: P6394PR)

[x] This foreign language document was filed in the PTO on September 7, 2001.

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Full name of the translator: Clifford E. Bender

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[Control number] J0083526 [Document title] Specification
[Title of the invention]
Apparatus and method for producing image data for printing, and recording medium storing the method

[Detailed description of the invention]
[0001]
[Technical field of the invention]
The present invention relates to an apparatus for producing image data for printing, and relates more specifically to an apparatus and a method for producing image data for printing that are capable of displaying the amount of ink required to print a color image generated for printing.
[0002]
[Prior art]
By presenting color images using 256 gradations each for red, green, and blue, modern color graphic processes can produce full-color images from a pallet of more than 16 million different colors, and full-color printers capable of printing such full-color images are now widely used. In order to print in color, these printers typically use cyan (C), magenta (M), yellow (Y), and black (K) ink to express the full range of colors by mixing small amounts of different colors of ink.
[0003]
While monochrome printers have typically been used for business applications because of their speed and economy, full-color printers are also beginning to be used as a result of advances in color graphics technologies. However, while full-color printers offer the advantage of rich color expression, disadvantages are that printing takes longer and operating costs are higher. However, in particular business applications, such as where there is a one-on-one relationship with a customer involving a printing process operation and handing the printer output to the customer, printing must be completed in the shortest possible time. In a POS system, therefore, image data is stored inside the printer as logo data so that a print logo command can be simply sent to the printer to read the image from memory, thereby saving the image data transmission time and enabling printing to finish in a short time. This method of storing logo image data in the printer is especially important for commercial color printing applications because color image files are so large. This logo printing technology can also be used in any field where the same image is repeatedly printed.
[0004]
Due to the need for economy and speed, color printers limited to two specific printable colors have begun to be used as color printers for such specialty applications. These logo

printing and two- or three-color color-limited printing technologies are particularly beneficial for bank ATM printers, printers for printing queuing numbers and parking lot tickets, kiosk terminal printers in convenience stores and other types of specialty printers that repeatedly print the same image. Because printing for applications such as these is typically printing text data in black, two-color color printers for printing black and one other color (one color selected from among red, green, and blue) as the colors printable by the color-limited printer are generally used, but the printer could use a color other than black or could be a three-color color printer adding one more printable color. With this type of color-limited printer full-color images and other images containing many colors cannot be printed as is, and an image process for creating a printable image by reducing the full-color image to the colors printable by the printer is therefore run. This image process for creating a printable image is a process for improving the print quality of a repeatedly printed image and the design quality of the image itself, and image processing may be required even when the color reduction process is not needed.

[0005]

[Problem to be solved by the invention]

Regardless of personal use or business use, when printing images with a printer there are times when it is desirable to know how much ink is needed to print an image when the print image is created or before image printing starts. Because it is necessary to reduce operating costs particularly in business applications, it is important when creating an image (such as a logo) that will be repeatedly printed to create the print image while also considering how much ink will be consumed by the printed image. A large amount of ink is particularly consumed by printing the background of the print image, and ink consumption by the printed image is therefore an extremely important factor affecting operating costs with a repeatedly printed image. In addition, if a two- or three-color printer is used for color image printing and the background or other large print area is printed with the same color, there is a strong possibility that only one color of ink will be lopsidedly consumed. The problem here is that lopsided use of one color means the ink cartridge for that one color will need to be frequently replaced, and this increases the burden of printer maintenance operations.

[0006]

The present invention is directed to a solution for the above problems, and an object of this invention is to provide an apparatus and a method for producing image data for printing that are able to display how much ink is required to print the print image when the print image is created or before printing. A

further object of the invention is to provide an apparatus and a method for producing image data for printing that are able to display for each color of ink how much ink is required to print the print a full-color image. A further object of the present invention is to provide an apparatus and a method for producing image data for printing that are able to report the life of the ink cartridge when printing a printed ticket containing the created logo in part thereof for use in POS printers, ATM printers, queuing ticket printers, and other such specialty printers for printing some sort of ticket with a logo printed in part of the printed ticket.

[0007]

It should be noted that "logo data" as used herein is not limited to logo data used in a POS system, and includes all types of frequently printed image data that is pre-registered (in non-volatile storage) in the printer and printed by applying a special print command. Therefore, image data stored in the printer of a POS system, ATM, parking ticket machine, or queuing ticket printer is also considered logo data.

Furthermore, "logo" as used herein does not refer only to logos as used by companies or stores, and also includes marks containing advertising copy, product and service coupons, and even announcement notices. It will be obvious that a print image created by the apparatus and a method of the present invention for producing image data for printing shall not be limited to logo data, and the present invention can be applied to any print image, whether an image for a New Year's card, a brand character, or a cartoon character.

Furthermore, "ink" as used herein includes all color-producing materials used to produce color (including black) for the purpose of printing an image, and is specifically not limited to ink such as used in an inkjet printer.

Furthermore, a "printed ticket" as used herein means a printed paper such as a receipt, parking ticket, queuing number ticket, or ATM transaction receipt containing in part thereof a print image generated by the present invention, and is used to mean all such sheets used to repeatedly print particular printed information for individual customers using a standard form in specific business applications.

[0008]

The present invention counts the number of print dots in a created print image, calculates the amount of ink required to print the print image from the counted number of print dots and the amount of ink required to print a unit dot, and displays the calculated ink quantity as the amount of ink required to print the print image. The amount of ink required to print the print image can therefore be known when the print image is created, and

the operating cost needed for image printing can be known. It is also possible to calculate the number of receipts printable per cartridge unit from the ink usage quantity, and to calculate ink cartridge life.

[0009]

An apparatus for producing image data for printing according to a first aspect of this invention has a source image capturing control unit for capturing or creating a source image that will be the basis for creating a print image; an image processing unit for generating a print image from the captured or [created] source image; a print image storage unit for storing the created print image; an ink consumption calculating unit for calculating the amount of ink required to print the created print image; and a display unit for displaying the calculated ink consumption.

The amount of ink used by a generated print image can thus be determined, and the operating cost of the ink can be calculated.

[0010]

In an apparatus for producing image data for printing according to a second aspect of the invention the ink consumption calculating unit counts the number of dots in the print image, and calculates ink consumption per print image by multiplying the counted number of dots by the ink consumption per unit dot.

[0011]

It is therefore possible to calculate how much ink is used by the created print image from the number of printed dots.

[0012]

In an apparatus for producing image data for printing according to a third aspect of the invention the print image storage unit stores data for each color of ink used to print the print image, and the ink consumption calculating unit calculates ink usage for each color of ink.

[0013]

It is therefore possible to determine ink usage for each color of ink used, predict ink consumption at the time of image creation, facilitate reducing the operating cost by adjusting the print image and lightening image colors, and adjusting the balance of ink consumed by the printer.

[0014]

In an apparatus for producing image data for printing according to a fourth aspect of the invention the ink consumption calculating unit further calculates the amount of ink required to print the print image based on factors relating to ink consumption by the printer.

[0015]

In an apparatus for producing image data for printing according to a fifth aspect of the invention the ink consumption

calculating unit stores ink consumption per dot according to printer type as a factor related to ink consumption by the printer, and calculates ink consumption according to the specified printer type.

[0016]

In an apparatus for producing image data for printing according to a sixth aspect of the invention the ink consumption calculating unit further calculates ink consumption per printed ticket where the printed ticket is printed with specific data and print image for a specific task.

[0017]

In an apparatus for producing image data for printing according to a seventh aspect of the invention the ink consumption calculating unit further calculates the average number of receipts printable per ink cartridge unit from the calculated ink consumption per printed ticket.

[0018]

In an apparatus for producing image data for printing according to an eighth aspect of the invention the ink consumption calculating unit further stores the calculated ink consumption per printed ticket unit and average number of printed tickets issued in a specific period, and calculates average ink cartridge life from the ink consumption per printed ticket and average number of printed tickets issued.

[0019]

An apparatus for producing image data for printing according to a ninth aspect of the invention is further characterized by being able to output the calculated results obtained by the ink consumption calculating unit together with the print image and print data.

An apparatus for producing image data for printing according to a tenth aspect of the invention is further characterized by the printed tickets including receipts issued by a POS printer, transaction slips issued by an ATM, queuing number tickets issued by a queuing ticket machine, and parking tickets issued by a parking ticket machine.

An apparatus for producing image data for printing according to an eleventh aspect of the invention is further characterized by the print image being a print image for a POS printer, a print image for an ATM, a print image for a queuing ticket machine, or a print image for a parking ticket machine.

An apparatus for producing image data for printing according to a twelfth aspect of the invention is further characterized by the print image being logo data registered in the printer.

[0020]

A method for producing image data for printing capable of displaying the amount of ink required to print a print image

according to a preferred embodiment of this invention has (a) a source image capturing step for capturing a source image that will be the basis for creating a print image; (b) an image processing step for generating a print image from the captured or created source image; (c) a print image storage step for storing the created print image; (d) an ink consumption calculating step for calculating the amount of ink required to print the created print image; and (e) a display step for displaying the calculated ink consumption.

[0021]

In a method for producing image data for printing according to a second aspect of the invention the (d) ink consumption calculating step counts the number of dots in the print image, and calculates ink consumption per print image by multiplying the counted number of dots by the ink consumption per unit dot.

[0022]

In a method for producing image data for printing according to a third aspect of the invention the (c) print image storage step stores data for each color of ink used to print the print image, and the (d) ink consumption calculating step calculates ink usage for each color of ink.

[0023]

In a method for producing image data for printing according to a fourth aspect of the invention the (d) ink consumption calculating step further calculates the amount of ink required to print the print image based on factors relating to ink consumption by the printer.

[0024]

In a method for producing image data for printing according to a fifth aspect of the invention the (d) ink consumption calculating step further calculates the average number of receipts printable per ink cartridge unit from the calculated ink consumption per printed ticket.

[0025]

In a method for producing image data for printing according to a sixth aspect of the invention the (d) ink consumption calculating step further stores the calculated ink consumption per printed ticket unit and average number of printed tickets issued in a specific period, and calculates average ink cartridge life from the ink consumption per printed ticket and average number of printed tickets issued.

[0026]

A further aspect of the present invention is characterized by achieving the functions of the present invention by means of a central processing unit (CPU), ROM, RAM, display device, input/output device, and interface, and a control program and data set stored to ROM or RAM. This control program and data set,

as well as a recording medium storing this control program and data set, are also included as embodiments of the invention.
[0027]

{Preferred embodiments of the present invention]

Preferred embodiments of the present invention are described below. It should be noted that the embodiments described below are for descriptive purposes and shall not restrict the scope of the present invention. It will be apparent to those skilled in the art that various changes and modifications are possible by replacing some or all of these elements with an equivalent, and such changes and modifications are to be understood as included within the scope of the present invention.
[0028]

(Scope of the present invention)

As noted above the scope of the present invention is not limited to special business applications. However, being able to determine ink consumption when creating the print image is particularly useful in such business applications as logo printing. A POS system, for example, prints a large number of receipts every business day. A logo identifying the store, for example, is usually printed to every receipt, and advertising information is also frequently printed to the receipt. Knowing how much ink is required to print a logo is therefore a particularly valuable function because it is possible to determine the printer operating cost per receipt. Creating the logos used as such print images is therefore thought to be one of the most typical applications for an apparatus for producing image data for printing according to the present invention. Therefore, when a specific print image is needed in the following description of a preferred embodiment of the invention, the following description imagines creating a print image for a POS printer, and particularly creating a logo.
[0029]

Referring to a logo generally means data registered as a store logo for printing by a POS printer, but as noted above the present invention is not limited to store logos and such, and a logo as used herein means all data registered to a printer for printing, including product advertising image data, announcement information image data, image data for coupons, and image data for discounted tickets. Logos printed for such diverse objects require a good design and recognizability, and color printing is therefore desirable, but it is also necessary to consider print economy, including ink consumption.
[0030]

(An example of image printing with a printer)

Printers print by receiving print data and print commands. POS printers can also receive the image data to be printed at

each print operation. When the data is received at the time of printing, however, much time is required to send the print data because of the large size of image data files, and the printing speed therefore drops. POS printers therefore internally store the image data needed for frequently printed logos, and read the logo data from memory when a logo data print command is received. When the image data to be printed this way is a color image, RGB color data is converted to CMYK color data for printing. When the logo data is color, color data for each pixel is stored in nonvolatile memory in the printer. The stored color data can be stored as RGB color data, but is generally stored as CMYK color data that can be printed as is without a conversion process. As noted above, color printing requires converting from RGB colors to CMYK, but because these conversion technologies are common knowledge the present invention describes only image processing with RGB colors. A print image created by the present invention is ultimately converted to CMYK color data and stored (registered) as print or logo data.

[0031]

The order in which logo image data is printed by a POS printer is described briefly below using a typical example (not shown in the figures). When a logo print command is received, the logo data specified by the command is read and then converted to the form that will be printed as color image data in the print buffer. The image stored to the print buffer consists of a matrix of pixels or dots digitized for each print color. The resulting dot data digitized for each color and stored to the print buffer is then sent to the print mechanism according to the print color as controlled by the printing controller.

[0032]

The print mechanism prints sequentially according to the dot data received from the print buffer by means of a print head for each print color while transporting the receipt paper passed the front of the print head. A logo is thus printed to a specified position on the receipt. With an inkjet printer, for example, ink is discharged each time the dot data is "on." An ink cartridge is connected to the print head and normally supplies ink. Ink consumption is proportional to the number of dots ("on" dot data) in the print image. Because the dot data forming the image is generated for each color, the amount of ink required to print the print image can be determined by counting the dots. The present invention is not directly related to the print operation and instead relates to creating the print image to be printed, and further description of the printing operation of the printer is therefore omitted below.

[0033]

(Preferred embodiment of an apparatus for producing image data for printing according to the present invention)

Fig. 1 is a function block diagram showing the functions of a print image generating apparatus 10 according to a preferred embodiment of this invention. The print image generating apparatus 10 shown in Fig. 1 has an input/output control unit 11, source image capture control unit 12, image processing unit 13, main control unit 14, print image storage unit 15, output buffer 18, ink consumption calculating unit 19, and display unit 23. This embodiment further assumes a two-color printer, and the print image storage 15 therefore has a first print image memory 16 and a second print image memory 17. The ink consumption calculating unit 19 also comprises a calculated data memory unit 20, ink consumption calculation control unit 21, and dot counting unit 22.

[0034]

In the creation of a print image a source image that will be the basis for the print image is captured from an external file, scanner, or other source based on the control of source image capture control unit 12 under the control of the main controller 14. The image processing unit 13 has, for example, a file reading control device or scanning device, and can read full-color images and other types of image data to be used as the source for creating the print image from an externally connected disk, CD-R, memory card, or other device. By providing a drawing function in the source image capture control unit 12, the source image capture control unit 12 can be configured so as to generate a source image based on input from the input/output control unit 11.

[0035]

The source image captured by the source image capture control unit 12 is stored to image processing unit 13. The image processing unit 13 is controlled by the main control unit 14 and generates a print image by manipulating and editing the source image and running image processes for adjusting the source image according to the functions of the printer used for printing. How colors are assigned when generating a two-color image from a multiple color source image for printing to a two-color printer limited to using two colors of ink greatly affects the perception and impression of the printed image, and image processing is therefore important. In addition to these conventional image design considerations, image processing is also important from the economic standpoint, that is, how much of what colors are used in the created print image. As noted above, the consumption of ink used in the logo has a major effect on operating cost in logo printing. Furthermore, various methods can be used in the image process for generating the print image, including different color reduction methods, gray scale processes, color gradation

processing using luminance conversion, color assignment processes, and color gradation allocation processes such as dithering, but the present invention does not relate directly to image processing itself and further discussion of specific image processing technologies is therefore omitted. We simply note that the image processing unit 13 of this invention can use any image processing technology that can be used by a person in this field.
[0036]

The print image generated by the image processing unit 13 is stored to the print image storage unit 15. The present embodiment has storage areas for two image colors, that is, first print image memory 16 and second print image memory 17, and a three-color color expression is therefore possible if the non-printing color (that is, the color of the print medium, usually white) is included. Even more color expressions are possible if dithering is used for color expressions using these three colors. For example, if the print image is expressed using four dots per pixel, up to fifteen color gradations can be expressed.

It should be noted that while the present embodiment has two image storage units, the first print image memory 16 and second print image memory 17, full-color print images can also be stored if four storage units for C, M, Y, and K are provided. Furthermore, if the images are stored in an additive color system such as RGB or YUV, full-color print image data can be stored using three image storage units. In this case however conversion to CMYK color data is required at the time of printing.
[0037]

When a print image is stored in the print image storage unit 15, the print image is sent from first print image memory 16 and second print image memory 17 through output buffer 18 to the display unit 23 and presented on the display unit 23 under the control of the main control unit 14. The main control unit 14 also controls the ink consumption calculating unit 19 at this time to calculate the amount of ink required to print the print image.
[0038]

The ink consumption calculating unit 19 controls dot counting unit 22 to count the number of dots requiring ink discharge (print dots) in the dot pattern for each color in the print image sent to the display unit 23, and thus counts the total number of dots printed for each color in the logo. The total number of print dots in the print image for each color is confirmed and sent to the ink consumption calculation control unit 21.

When the ink consumption calculation control unit 21 receives the total print dot count, it reads the ink discharge volume per dot for the nozzles of the print head stored to the

calculated data memory unit 20, and multiplies the discharge volume by the total dot count for each color determined by the dot counting unit 22. The results are then sent to the display control unit 23 for presentation on the display unit as the amount of ink of each color required to print the print image. If it is determined that ink consumption by the print image is too high or ink consumption is lopsided, ink consumption can be reduced or the ratio of colors used can be changed by lightening printing of the background color, setting part of the print image to not print, changing part to another color, or other image processing operation.

The ink consumption calculating unit 19 is described in further detail with reference to Fig. 2. Fig. 2 is a function block diagram showing the configuration of the ink consumption calculating unit 19 of a print image generating apparatus 10 according to this embodiment of the invention. As shown in Fig. 2 the calculated data memory unit 20 has a model-specific data memory 25 and environment-specific data memory 26, and the ink consumption calculation control unit 21 has a calculation controller 28 and equation memory 27. The model-specific data memory 25 stores information specific to the printer used for printing, and the environment-specific data memory 26 stores information relating to ink consumption in the operating environment of the printer used for printing.

[0039]

Fig. 3 (a) shows some of the information stored to model-specific data memory 25, and (b) shows some of the information stored to environment-specific data memory 26. The model-specific data shown in Fig. 3 (a) are factors why ink consumption differs in different printer models. For example, the ink volume discharged per dot is directly related to the amount of ink required to print one image (logo), is related to the ink volume used for head cleaning, and affects the number of receipts printed and ink cartridge life.

The environment-specific data shown in Fig. 3 (b) includes factors affecting ink consumption required for one receipt and affecting ink cartridge life, such as the average number of receipts printed per day, the number of work days per year, the logo size and whether a logo is printed, the bar code size and whether a bar code is printed, and the print mode (a mode for changing the ink consumption per dot and adjusting print density), and factors whereby ink consumption from the cartridge changes according to the operating environment of the printer. The average number of characters printed per receipt, the print mode, logo size and whether a logo is printed, bar code size and whether a bar code is printed affect ink consumption per receipt. The number of work days per year and whether a coupon is printed

affect cartridge life. It will be further noted that the data items in Fig. 3 are shown by way of example only, it is not necessary to store all of these items, and more items can be used in addition to these items.

In addition, the items shown in Fig. 3 indicate general categories and more specific information is needed for these general items. In any case, factors affecting ink consumption, including factors arising from the printer model or type, printer operating conditions, settings, operating environment and use, and all other information required to calculate ink consumption, even information that cannot be clearly placed into one certain category, can be included in the stored data. The stored content can be set and controlled using the input/output control unit 11. Elements printed to the receipt include (1) the logo (graphic), (2) transaction information (text, bar code), and (3) coupon information (text, bar code, graphic). In this case, receipts printed by the printer could include only element (2), elements (1) and (2) or elements (2) and (3), or elements (1), (2), and (3).

[0040]

Ink consumption for one of each type of receipt can be determined by determining ink consumption for each color in

A: text in the transaction information and coupon;

B: logo and coupon graphics;

C: bar codes in the transaction information and coupon;

and then obtaining the total for each color.

[0041]

Ink consumption for a type A receipt can be calculated by multiplying the average number of characters per receipt (including number of characters in the coupon information if a coupon is printed) by the ink consumption per character (obtained, for example, from the ink discharge per dot and average number of dots per character).

[0042]

Ink consumption for a type B receipt can be similarly calculated from the total number of print dots in the image and ink discharge per dot.

[0043]

Ink consumption for a type C receipt can be calculated from the dot count in the same way as a type B receipt, but can also be computed from the bar code size because the bar code print ratio is approximately 50%.

[0044]

The ink consumption calculating unit 19 is further described below referring again to Fig. 2. The model-specific data and environment-specific data read from the calculated data memory unit 20 is read by the calculation controller 28 and the amount

of ink required to print the print image and other ink consumption is calculated from this read information and the total print dot count received from the dot counting unit 22. The equations used for these calculations are stored to equation memory 27, and the required equations are thus read and ink usage, the number of printable receipts, number of printable characters, and ink cartridge life calculated.

Various equations that will be apparent to one skilled in the art can be used by this invention to calculate ink consumption and other consumption estimates by applying the model-specific data and environment-specific data. Any print image generating system that calculates and displays the required information using an equation apparent to one skilled in the art is also included in the scope of the present invention.

[0045]

The functions of a print image generating apparatus 10 thus comprised can be achieved with various configurations having a central processing unit (CPU), ROM, RAM, display device, input/output device, interface, control program stored to ROM or RAM, and the necessary data sets. The print image generating apparatus 10 is achieved by integrating the control program and data set with the CPU, ROM, RAM, and display. The control program and data set, as well as a data storage medium recording the control program and data set, are therefore also included within the scope of this invention.

[0046]

(Preferred embodiment of a print image generating method according to the present invention)

A print image generating method capable of displaying ink consumption is described with reference to Fig. 4. Fig. 4 is a flow chart of a print image generating method capable of displaying ink consumption according to a preferred embodiment of the present invention.

The first step is to create or capture the source image that will be the basis for print image generation (S101). This step can be accomplished by reading from an image file, capturing an image with a scanner, creating an image with a graphics program, or editing a scanned or read image. The source image is then processed to generate an appropriate print image (S102). As described with the print image generating apparatus above, various image processing techniques, including color reduction, image synthesis, and color assignment processing can be used. The resulting print image is then stored (S103). The amount of ink required to print the print image is then calculated and presented on the display (S104). Whether there is anything to change in the print image is then confirmed (S105), and if there is (S105 returns no), the image processing and ink consumption

calculation steps repeat (S101 to S105). If there is no change in the print image (S105 returns yes), the process ends. In this case the print image can be output as an image file, printed directly to a printer or registered as a logo in the printer.

[0047]

The ink consumption calculation and display step (S104) shown in Fig. 1 is described in further detail with reference to Fig. 5. Fig. 5 is a flow chart of a first embodiment of the ink consumption calculation and display step (S104) shown in Fig. 4.

When the image process ends and the print image is stored (S103, Fig. 1), it is determined if the print image is a color image (S111). If it is not a color image (S111 returns no), the total print dot count N in the stored print image data is counted (S112). Once the total print dot count N is determined, the internally stored ink discharge volume Pi per dot that is discharged from the nozzle is read (S113). Ink consumption Pt required to print the print image is then calculated as dot count N x Pi, and the result can be presented for confirmation by the user (S115).

[0048]

If a color image is printed (S111 returns yes), the number of print dots in the logo data is counted for each color to obtain print dot counts N1 and N2 for the respective colors (S116). The ink discharge for each dot discharged from a nozzle is then read (S117). Note that the ink discharge per nozzle is assumed to be Pi regardless of the color in step S117. Ink consumption amounts Pt1 and Pt2 for each color used to print the print image are then calculated from N1, N2, and Pi (S118). The calculated ink consumption amounts Pt1 and Pt2 are then displayed (S119).

[0049]

An alternative ink consumption calculation and display process is described next with reference to Fig. 6. Fig. 6 is a flow chart of a cartridge life calculation process as a second embodiment of the print image ink consumption calculation and display step (S104) shown in Fig. 4. When image processing ends and the print image is stored (S103 in Fig. 1), printer model-specific data such as the ink cartridge capacity (L) and ink consumed (C) by the head cleaning operation (S131) is read, and environment-specific data such as the number of receipts printed per day (N), is read (S132). This printer model-specific data and environment-specific data is as described above with reference to Fig. 3.

[0050]

The amount of ink used (R) to print one receipt is then calculated based on the read printer model-specific data and environment-specific data (S133). This amount of ink (R) required

for receipt printing differs according to the size of the logo and whether a logo is printed, the size of the bar code and whether a bar code is printed, and other factors. The amount of ink consumed to print one receipt is therefore calculated based on the environment-specific data. Note that here (and in the following steps) ink consumption is calculated separately for each color if the receipt is printed in color. When the ink consumption (R) per receipt is determined, the amount of ink consumed in one day for receipt printing (R x N) is determined from per-receipt ink consumption (R) and the number of receipts printed per day (N) (S134). The daily ink consumption (D) is then calculated by adding ink consumption (C) per day consumed by various head cleaning operations, which while not directly related to printing are ink consumption operations, to the daily receipt printing ink consumption (R x N) (S135). When the daily ink consumption (D) is determined, the ink cartridge capacity (L) is divided by the daily ink consumption (D) to determine the ink cartridge life (E = L/D) as the number of work days that a single ink cartridge will last (S136).

[0051]

The calculated ink consumption data and amount of ink required to print the print image are then displayed when requested or according to predefined conditions (S137). The calculated ink consumption information could also be printed out together with the print image or separately to the print image as requested.

Fig. 7 shows a sample display screen 30 for displaying a logo created as a print image and the amount of ink required for the logo. This display screen 30 has a logo data display part 31 at the top of the screen and a logo display 32 for showing the logo. A rounded mark 33 filled with design text and pattern is printed in the logo. The mark 33 is filled with black (first color) and red (second color). In addition, the logo data display 31 shows that the logo measures 63.92 mm x 30.76 mm [sic; Fig. 7 = 72.25 x 43.32 mm], and the total number of pixels in the logo is 453 dots by 218 dots [sic; Fig. 7 = 512 x 307 dots]. The ink ratio used in this logo shown in the logo data display part 31 also indicates that the first color covers 15.62% [sic; 8.32%] and the second color covers 8.01 % [sic; 15.58%] of the overall logo. While this display does not directly show ink consumption, ink consumption by the overall logo and the ratio between the colors of ink can be understood. This ink ratio and other information is calculated and displayed by the ink consumption calculating unit of the present invention.

[0052]

Fig. 8 shows three different sample receipts. Print sample (1) contains text data only and no logo. This type of receipt can

be printed with little ink. Print sample (2) contains the logo shown in Fig. 7 as well as a bar code 34 and advertising information 35. A relatively large amount of ink is consumed to print this type of receipt. Print sample (3) contains a logo 36 and discount coupon 37. As will be known from these different types of receipts, modern POS systems can print various types of information to a receipt to excellent effect, but ink consumption also increases greatly. Techniques such as using a lighter color to print the background of the logo 36 as shown in print sample 3 are therefore also important with respect to the operating cost.
[0053]

Fig. 9 (a) shows another sample display 40 showing consumption of ink for a print image, and (b) shows a sample cartridge life display. The display shown in (a) also has logo data display 31 and logo display 32 areas. This sample display 40 also shows the size together with ink consumption by weight separated into the first and second colors in the logo data display 31. In (b) data relating to various ink consumption amounts is shown in table form.
[0054]

[Effect of the invention]

It is therefore possible by means of the present invention to know how much ink is required to print when the print image is generated, and it is therefore possible to create the print image with consideration for operating costs. It is also possible to calculate from the ink consumption data the number of receipts that can be printed per cartridge unit, and it is therefore also possible to calculate ink cartridge life.

[Brief description of the drawings]

Fig. 1 is a function block diagram of a print image generating apparatus able to display ink consumption information according to a preferred embodiment of the invention.

Fig. 2 is a function block diagram showing the configuration of an ink usage calculating unit of a print image generating apparatus according to the invention.

Fig. 3 (a) shows an example of part of the information stored to model-specific data memory 25, and (b) shows an example of part of the information stored to environment-specific data memory 26.

Fig. 4 is a flow chart of a print image generating method able to display ink consumption information according to a preferred embodiment of the invention.

Fig. 5 is a flow chart showing a first embodiment of the print image ink usage calculation and display step shown in Fig. 4.

Fig. 6 is a flow chart showing a second embodiment of the print image ink usage calculation and display step shown in Fig. 4.

Fig. 7 shows a sample display showing a logo generated as a print image and the amount of ink required to print the logo.

Fig. 8 shows three different samples of printed receipts.

Fig. 9 (a) shows another display screen presenting ink consumption information for a print image, and (b) shows a table displaying ink cartridge life information.

[Key to the figures]

10 print image generating apparatus
15 print image storage unit
19 ink consumption calculating unit
20 calculated data memory unit
21 ink consumption calculation control unit
30 sample display screen
31 logo data display area
32 logo display area
34 bar code
35 advertising information
37 discount coupon

[Document title] Abstract

[Abstract]

[Problem] To provide an apparatus and a method for producing image data for printing that are capable of displaying the amount of ink required to print a print image when the print image is created or before printing.

[Means of solving the problem]

The number of print dots in the created print image is counted, the amount of ink needed to print the created print image is calculated from the counted number of print dots and the amount of ink required to print a unit dot, and the calculated ink amount is displayed as the amount of ink required to print the created print image. The number of printable receipts per cartridge unit and the ink cartridge life are also calculated from the ink consumption and displayed.

[Selected figure] Fig. 1

TEXT IN THE FIGURES

FIG. 1

FROM INPUT/OUTPUT DEVICE --> I/O CONTROLLER 11
EXTERNAL FILE, OTHER --> SOURCE IMAGE CAPTURE CONTROLLER 12
IMAGE PROCESSOR 13
MAIN CONTROLLER 14
FIRST PRINT IMAGE MEMORY (FIRST COLOR) 16
SECOND PRINT IMAGE MEMORY (SECOND COLOR) 17
OUTPUT BUFFER 18
CALCULATED DATA MEMORY UNIT 20
INK CONSUMPTION CALCULATION CONTROLLER 21
DOT COUNTER 22
DISPLAY CONTROLLER 23
--> TO DISPLAY
--> TO FILE STORAGE DEVICE OR PRINTER

FIG. 2

FROM I/O CONTROLLER 11 --> MODEL-SPECIFIC DATA MEMORY 25
ENVIRONMENT-SPECIFIC DATA MEMORY 26
EQUATION MEMORY 27
CALCULATION CONTROLLER 28 --> TO DISPLAY DEVICE 22 [sic]
FROM MAIN CONTROLLER 14 -->
FROM OUTPUT BUFFER 18 --> DOT COUNTER 22
TO OUTPUT BUFFER 18 <--

FIG. 3

(A)

CALCULATION DATA (PRINTER MODEL-SPECIFIC DATA): SAMPLE CONTENT
INK CONSUMPTION PER DOT
HEAD CLEANING DATA (INK CONSUMPTION PER DAY FOR HEAD CLEANING)
INK CARTRIDGE DATA (INK CAPACITY PER COLOR)
RESOLUTION
OTHER
PRINTER MODELS A B C

(B)

CALCULATION DATA (ENVIRONMENT-SPECIFIC DATA): SAMPLE
AVERAGE NUMBER OF RECEIPTS PRINTED PER DAY
NUMBER OF WORK DAYS PER YEAR
AVERAGE NUMBER OF CHARACTERS PER SHEET
LOGO PRINTING (YES/NO)
BAR CODE PRINTING (YES/NO, SIZE, OTHER)
COUPON PRINTING (YES/NO, SIZE, OTHER)
PRINT MODE DATA
OTHER

FIG. 4
DISPLAY INK USAGE
S101 CREATE OR CAPTURE SOURCE IMAGE
S102 IMAGE PROCESSING FOR PRINT IMAGE GENERATION
S103 STORE PRINT IMAGE
S104 CALCULATE AND DISPLAY INK USED FOR PRINT IMAGE
S105 SAVE PRINT IMAGE?
END

FIG. 5
CALCULATE AND DISPLAY INK USAGE
S111 COLOR PRINT IMAGE?
S112 COUNT TOTAL NUMBER OF PRINT DOTS N IN PRINT IMAGE
S113 READ INK CONSUMPTION Pi PER DOT
S114 CALCULATE N1 x Pi = Pt
S115 CALCULATE Pt
S116 READ PRINT DOTS IN PRINT IMAGE, COUNT TOTAL COUNT N1, N2 FOR EACH COLOR
S117 READ INK CONSUMPTION Pi PER DOT
S118 CALCULATE INK USAGE FOR EACH COLOR
N1 x Pi = Pt1
N2 x Pi = Pt2
S119 DISPLAY INK USAGE FOR EACH COLOR, Pt1, Pt2
RETURN

FIG. 6
CALCULATE AND DISPLAY CARTRIDGE LIFE
S131READ PRINTER MODEL-SPECIFIC DATA (INK CARTRIDGE CAPACITY (L), INK CONSUMED BY CLEANING (C))
S132 READ ENVIRONMENT-SPECIFIC DATA (NUMBER OF RECEIPTS PRINTED PER DAY (N))
S133 CALCULATE INK USED (R) TO PRINT ONE RECEIPT FOR EACH COLOR (PRINTING LOGO AND TEXT)
S134 CALCULATE INK CONSUMED TO PRINT RECEIPTS FOR 1 DAY (R x N)
S135 CALCULATE DAILY INK CONSUMPTION (D) = R x N + C
S136 CALCULATE CARTRIDGE LIFE E = L/D FROM INK CARTRIDGE CAPACITY (L)
S137 DISPLAY CALCULATED DATA
RETURN

FIG. 8
PRINT SAMPLE 1
PRINT SAMPLE 2
PRINT SAMPLE 3

FIG. 9
(a)

IMAGE (LOGO) INK CONSUMPTION (SAMPLE)
SIZE a x b COLOR 1: xx ng COLOR 2: xx ng
(b)
INK CONSUMPTION AND CARTRIDGE LIFE (SAMPLE)
ITEM (TYPE)
PER RECEIPT
PER DAY
CARTRIDGE LIFE
NUMBER OF PRINTABLE CHARACTERS
NUMBER OF PRINTABLE RECEIPTS
CONTENT
INK CONSUMPTION, COLOR 1 XX; COLOR 2 XX
INK CONSUMPTION, COLOR 1 XX; COLOR 2 XX
NUMBER OF WORKING DAYS: XX DAYS
XX THOUSAND CHARACTERS
XX PCS